Development of Deep River Indicators of Biological and Physical Habitat Condition

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Vision

Enable states, regions, and tribes to evaluate the condition of deep rivers using biological data.

Key Objectives

• To develop a comprehensive deep river bioassessment method modifying widely used wadeable streams techniques and using existing boating techniques.

• To evaluate, in a comparative field test, the strengths and weaknesses of three widely used study designs, and the appropriateness of each under different conditions.

• To define the most efficient and robust set of measurements and methods that can be used for bioassessment of fish, macroinvertebrate and algal communities and assessment of physical habitat in a range of river types.

• To provide these methods to assessors and managers in a clear and concise document designed to provide guidance for deep river bioassessment.

Methods

Principle indicators included in the study are algae (USEPA-EMAP-SW and USGS-NAWQA programs only), benthic macroinvertebrates, fish, and physical habitat. Biological and indicator methods are summarized in the accompanying tables. Site access was the primary focus in determining the location of study sites with consideration also given to spatial distribution, habitat type variety and suspected stressors. Twenty sites each were selected to be sampled on the Great Miami and Scioto Rivers and 10 sites each were selected to be sampled on the Kentucky and Green Rivers. Reconnaissance was conducted based on the local and researched knowledge of public boat ramps and public lands. Once that avenue was exhausted, investigation of privately owned lands was researched.
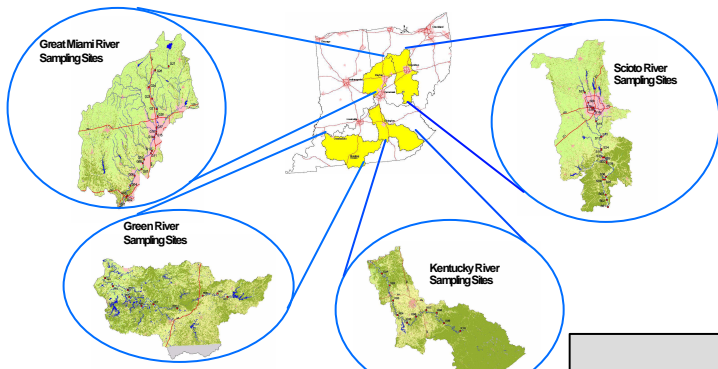
Study Areas:
Methods from all three programs were comparatively field tested over one season in four different rivers (i.e., Scioto, Great Miami, Kentucky, and Green Rivers) which are tributaries of the Ohio River. These rivers were selected to reflect a range of watershed land uses, stressors, geo-hydrological influences and habitat types.

Sampling Schedule:
Sampling started on the Great Miami and Scioto Rivers in June, 1999. Sampling at sites on the Kentucky and Green Rivers started in late August, 1999. All sampling was completed by the end of September, 1999.

The Great Miami River
is mostly in the Eastern Corn Belt Plain (ECBP) ecoregion (Omernik, 1987) but the last 25 miles pass through the Interior Plateau ecoregion. The drainage basin covers approximately 5385 square miles. The river main stem is 170 miles long with an average gradient of approximately 3.9 feet per mile (OEPA, 1997a). The river lies within a broad valley with a wide flood plain (OEPA, 1997a). The predominant land use in the upper Great Miami watershed is agricultural. The lower Great Miami River is frequently channelized and impounded as it flows through the urban and industrial corridor from Dayton to Hamilton, Ohio, but the final reach of the river west of Cincinnati, Ohio is still largely free flowing and forested, though this section is affected by flood plain agriculture and gravel mining operations.

Great Miami River Sampling Sites

Green River Sampling Sites

Scioto River Sampling Sites

Kentucky River Sampling Sites

The Scioto River
is a major tributary of the Ohio River with a drainage area of 6517 square miles. The river is 230 miles long with an average gradient of 2.3 feet per mile (OEPA, 1997b). The main stem of the river flows through both the ECBP and the Western Allegheny Plateau ecoregions. The upper portion of the watershed is typical till with gently rolling to nearly flat terrain. Land use in this area of the watershed is predominantly agricultural though there is urban influence around Columbus, Ohio. The lower reach of the river is forested with agriculture confined to a narrow floodplain.

The Green River
basin in western Kentucky includes an area of approximately 8896 square miles. The Green River flows 330 miles from its headwaters in West Central Kentucky to its confluence with the Ohio River near Owensboro, Kentucky. The river basin varies in topography from rolling plateau in the upper reaches to a broad floodplain near the mouth. The lower and middle sections of the river are locked and dammed and the system is considered navigable as far upstream as the mouth of the Barren River. Land use in the watershed is predominantly agricultural with areas distributed among row crops, pasture and woodlots. Strip mining has been practiced extensively in the Western Coalfield portion of the watershed and is a major influence in that region. The largest urban influences in the basin are the population, business and manufacturing centers of Bowling Green, Elizabethtown, Glasgow and Madisonville, Kentucky (NDEP, 1976).

The Kentucky River
basin includes an area of approximately 7000 square miles. The river originates in the Appalachian uplands of southeastern Kentucky and flows northwest 255 miles through 14 locks and dams, joining the Ohio River at Carrolton in north-central Kentucky. The average slope of the mainstem is 6.7 feet per mile. The southeastern portion of the watershed is forested with limited agricultural use and primary stressors are coal mining and forestry. The central part of the watershed is predominated by agricultural use with some urban influence from Lexington and Frankfort, Kentucky. The final portion of the watershed is approximately evenly split between forest cover and agriculture (Kentucky River Authority, 1999).

Project Status

• Field sampling for the 'Deep River Methods Comparison and Development' project has been completed on schedule.

• Habitat and biological data, via all proposed methods, collected at 60 sites.

• Biological samples that require processing and identification of collected specimens (periphyton and benthic macroinvertebrates) have been received by the designated laboratory.

• All samples have been processed for safe storage.

• The date for the completion of sample evaluation is not currently available.

• Vertebrate (fish) data collected from sample locations are currently being entered into a database.

• Exploratory analysis for comparing the results of the various vertebrate collection methods is anticipated to begin as soon as a reasonable portion of the data has been entered.

References

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Kentucky River Authority, 1999. Kentucky River Basin Status Report. www.nr.state.ky.us/nrepc/kra/statu1.htm.

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Benthic Macroinvertebrate Sampling Methods

	EMAP	USGS	OEPA
Dip Net Method	Quantitative	Qualitative	Quantitative
Dip Net Time	Two 20-Second Kicks at 11 Transects	At Least 10 Min. per Available Habitat Type	At Least 30 Min. per Site
Dip Net Mesh Size	595 Microns	210 Microns	600 Microns
Additional Quantitative Methods Used	595-micron Drift Nets	Richest Targeted Habitat	Hester-Dendy Samplers

Electrofishing Sampling Methods

	EMAP	USGS	OEPA
Sampling Distance	40 X the Wetted Width	20 X the Wetted Width	500 Meters
Maximum Distance	2000 Meters	1000 Meters	500 Meters
Number of Banks Sampled	One	One	Two

Algae Sampling Methods

	EMAP	USGS
Quantitative Periphyton Collection Methods	12 cm² Substrate From Each of 11 Transects	3.33 cm² Substrate From Richest Targeted Habitat
Qualitative Periphyton Collection Methods	None	A Sample From Each Available Habitat Type
Periphyton Analysis Parameters	Biomass, Chlor a, ID/Enum	Biomass, Chlor a, ID/Enum
Phytoplankton Collection Methods	None	1-L Integrated Sample
Phytoplankton Analysis Parameters	Not Applicable	Biomass, Chlor a, ID/Enum